TECHNICAL DOCUMENTATION AND FINDINGS: CONFORMITY ANALYSIS FOR THE FISCAL YEAR 1993-1999 REGIONAL TRANSPORTATION IMPROVEMENT PROGRAM AMENDMENT

SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS

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ABSTRACT

The following study approach addresses the three interim conformity requirements:

1. Requirement #1: SCAG's Fiscal Year 1993-1999 Regional Transportation Improvement Program (RTIP) Amendment is consistent with the most recent estimate of mobile source emissions.
2. Requirement #2: SCAG's FY 1993-1999 RTIP Amendment provides for expeditious implementation of the Transportation Control Measures (TCMs).
3. Requirement #3:SCAG FY 1993-1999 RTIP Amendment contributes to annual emission reductions in Carbon Monoxide and ozone in non-attainment areas.

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CHAPTER 1: STUDY APPROACH

A. Analysis Based on the Interim Requirements

The following study approach addresses the three interim conformity requirements.

Requirement #1: SCAG's Fiscal Year 1993-1999 Regional Transportation Improvement Program (RTIP) Amendment is consistent with the most recent estimate of mobile source emissions.

Approach: The analysis is based on the most recent population, employment, travel, and congestion estimates prepared by SCAG as the Metropolitan Planning Organization. EMFAC7Fl.l Emission Factors were used in the 1993-99 RTIP Amendment Conformity Analysis.
Requirement #2: SCAG's FY 1993-1999 RTIP Amendment provides for expeditious implementation of the Transportation Control Measures (TCMs).

Approach: TCMs in the RTIP Amendment include, but are not limited to, regional and inter-city transit, High Occupancy Vehicle (HOV) lanes, traffic signalization improvements, freeway and highway capacity enhancements, intersections improvements, bicycle facilities, and freeway traffic management technologies. SCAG has embarked on an ambitious effort with the region's transportation commissions and councils of governments to document and quantify local Transportation Control Measures.

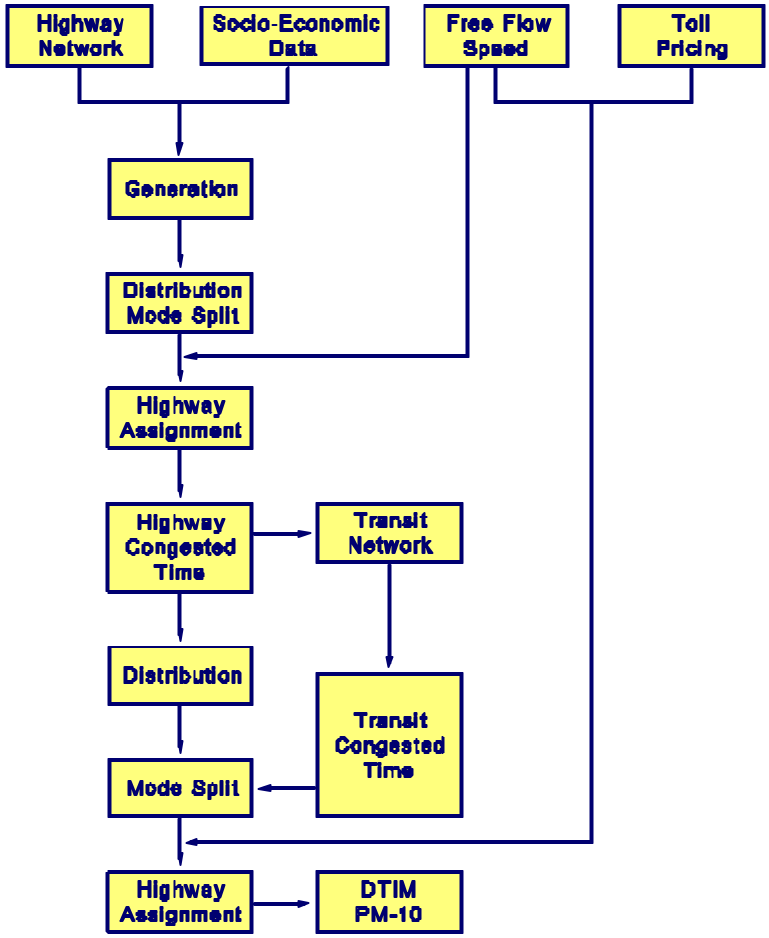
Requirement #3: SCAG FY 1993-1999 RTIP Amendment contributes to annual emission reductions in Carbon Monoxide and ozone in non-attainment areas.

Approach: The Interim Guidance requires a quantitative analysis of the emissions impact of transportation plans and programs where such techniques are available. SCAG used the Regional Transportation Modeling System which includes the TRANPLAN based travel demand model, the Direct Travel Impact Model (DTIM) to estimate emissions (CO, NOX, ROG, and PT), PM- 1 0, and the DRAM/EMPAL models to forecast changes in land use distributions based on travel characteristics.

The 1993-1999 RTIP Amendment compares the 'Build" to the "No Build" scenario for the attainment years for carbon monoxide (CO) and ozone, and both are then compared to the 1990 base year emissions. These comparisons are made through a series of five model runs, using the 1994 Growth Management Element (GME) socioeconomic data for the Regional Transportation Model, comparing emissions from the RTIP Amendment 'No Build' to the "build" projects scenario.

Emissions data from the 'Build' scenarios were compared to the 'No Build' scenarios for the analysis years for the total SCAG modeling area and by air basins (South Coast Air Basin-SCAB, Southeast Desert Air Basin-SEDAB, and the Ventura County Air Pollution Control District-VCAPCD. Emissions data were calculated for 1990, 2000, 201 0, and 2015 for CO, NOX, ROG, and PM-10 and the emissions for the intervening years, from 1994 to 1996, 2005, and 2007 were estimated by interpolation. Figures 1-1 and 1-2 shows the general procedures used for the 1993-1999 RTIP Amendment Conformity Analysis.

Figure 1-1: RTIP 93-99 Conformity Analysis Modeling



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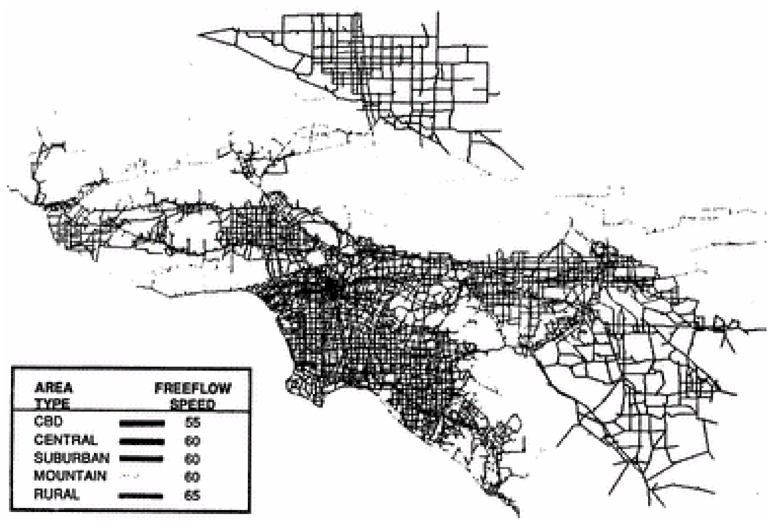


B. Model Improvements

The SCAG model used for the RTIP 1993-1999 Amendment Conformity Analysis incorporated several improvements as detailed in the following.

1. Extended Modeling Area

The SCAG Regional Modeling area has been expanded to include Victor and Cochlea Valleys. Initially these areas in the Southeast Desert Air Basin were excluded from the model because they were undeveloped. However, there have been significant growth in these valleys within the last 2 decades and these more urbanized areas will now be included in the air quality analysis as part of the improvement to the SCAG Regional Model.

2. Toll Pricing

In order to assess the impacts that toll pricing has on highway assignments, a toll component was incorporated into the 1993-1999 RTIP Amendment Conformity Analysis. Five toll facilities are described in Table 2-3 shown in Chapter 2.

Methodology

The TRANPLAN demand model software package provides a means for modeling the effects of toll charges within the highway assignment model. Links on the highway network representing the toll facilities are identified with cost values representing the toll charges which are then converted to time impedance's during the assignment phase. The initial toll charges are based upon pricing policy information received from the companies developing the five toll facilities. In 1991 dollars, the toll on SR-91 assumes a maximum charge of $2.90 during the peak periods and $0.70 during the off-peak periods. The other four toll facilities (SR-57, SJHTC, FTC, and the ETC) assumes a charge of $0.15

per mile during the peak periods and $0.075 per mile during the off-peak periods. Toll charges may vary depending on the number of persons per vehicle, time of day, and the direction of travel.

The dollar values were converted to time using a CTOLL value of 0.07 hours per dollar during the highway assignment phase of the model. This is equivalent to a time value of approximately $14 per hour.

Toll charges were only applied to the years 2000, 2010, and 2015. Details of toll road system characteristics (i.e., mixed flow lanes, and HOV lanes, etc.) are described in Chapter IV under Model Description in the trip assignment section.

Pricing Strategy

The toll model is able to distinguish between vehicle modes. That is vehicles are charged varying rates depending on the number of persons in the vehicle (e.g., $2.00 for one-person and $1.00 for 2-or-more person vehicles). The procedure is set up to simultaneously assign separate trip tables for different vehicle modes onto different facility types (i.e., mixed and HOV) or on the same facilities but with different impedance's. These impedance's that vary represent different charges by vehicle modes (described above) traveling on the same facility in a network (with or without HOV).

Pricing used for the toll roads for the RTIP 93-99 Amendment conformity analysis assumed that vehicles with 2 or more persons received a 50 percent discount from those charged Single Occupancy Vehicles (SOV).

3. Regulation XV and Rule 210 Pricing

The approached to modeling Regulation XV and Rule 210 was through the use of differential pricing of the parking cost variable in the SCAG mode split model. SCAG's conformity targets are to obtain a 60% effectiveness in year 2000 and 80% in years 2010 and 2015 of the Average Vehicle Ridership (AVR) requirements. The AVR requirements at 100% effectiveness would between 1.3 to 1.7. In order the achieve these conformity targets, the parking costs used in each Traffic Analysis Zone (TAZ) was varied. However, while the parking cost variable was used as a means to reflect the relative perceived cost differential between drive alone and other alternate modes, in reality, this differential will be created by a mix of employer-based incentive programs, such as transit, car or van pool, and parking cost subsidies.

4. Telecommute, Work at Home, and Non-Motorized Vehicle

One percent of all trip types were assumed to be non-motorized and were eliminated.

Trip elimination assumptions for part-time work at home due to telecommuting was based on an analysis of the 1991 SCAG Origin and Destination Travel Survey and a comparison of the 1980 and 1990 census data. In addition, the conservative projections (lowest level) from the Project California Task

Force Report (Dec 92) were used to forecast potential growth in telecommuting in future years. This resulted in the assumption of a reduction in home to work trips by 2.7% in the year 2000, and by 3.7% in the years 2010 and 2015. In addition, assumptions for work at home is 4.1% for all years.

5. Travel Demand Management (TDM) Pricing

Implementation of the Katz Parking Cash Out legislation in California and the Federal Energy Bill which provides for transit and ride share subsidies to employees. It was estimated by SCAG staff that approximately one half of all employees are likely to be eligible for a $60.00 per month subsidy from their employers. It was not possible to apply a subsidy to one half of the home-to-work trips, so the enhanced effectiveness of these existing policies was modeled through a pricing mechanism equivalent to a $30.00 per month transit fare subsidy or by reducing auto operating costs for shared rides which would be provided by the private sector to employees.

6. Zero Emission Vehicles (ZEV)

Currently, SCAG assumes a total of on-road zero emission vehicles sold to be 2% by the year 2000 and 10% by the years 2010 and 2015, based on directions from the Advanced Transportation Technologies Task Force. It was the opinion of this Task Force that Advanced Transportation Technologies could be further encouraged through public policy and that 50% of the vehicles sold in 2010 or 60% in 2015 would be zero emission vehicles, as opposed to the 1 0%, currently in the emission factors. However, the emissions output from DTIM were reduced to reflect the greater ZEVS.

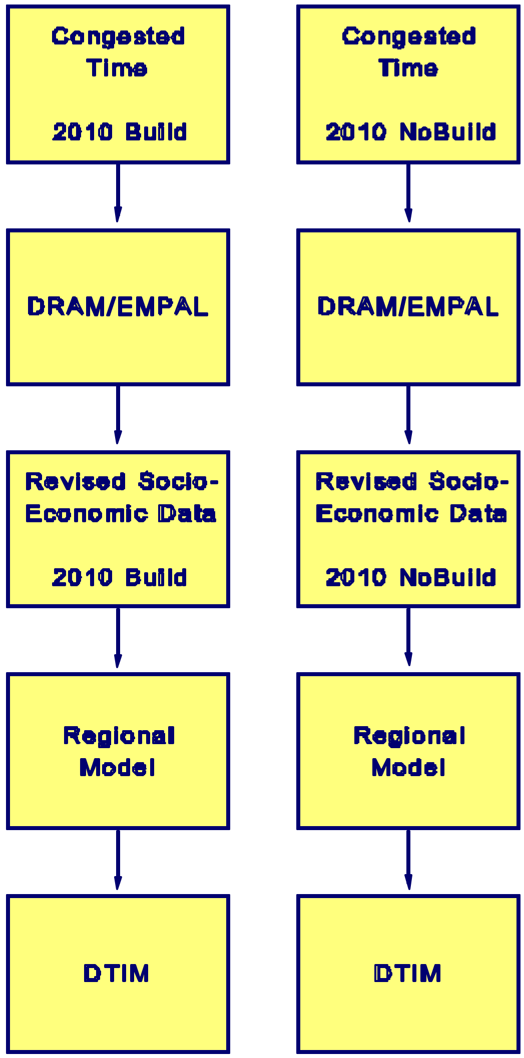
7. IVHS/ATMS/TSM

Advance Traffic Management Systems (ATMS) encompass a broad range of programs which enable a more efficient use of the existing transportation infrastructure. With programs such as HOV by pass lanes, ramp metering, recurrent and non-recurrent congestion measure actions, improvements in signalization and intersections, reductions in travel time delays are greatly improved. These programs were modeled by enhancing freeway and HOV capacity by an additional 2.5% in the year 2000 and 5% in the years 2010 and 2015. The benefits of Intelligent Vehicles Highway Systems (IVHS) were not included in this reduction of delays, as the 5% estimate by Caltrans is deemed conservative by SCAG staff, based upon a literature review on this topic.

C. Analysis of Impacts on Land Use

The DRAM/EMPAL Models, calibrated to reflect actual 1990 base year data, were utilized to test the land use consequences (and resulting emissions) of the 1993-1999 RTIP Amendment. The model run began with year 2010 socioeconomic projections from the 1989 GMP, and the effects of the build and no-build scenarios were examined. Revised travel times from each scenario was fed back into the DRAM/EMPAL Models, and a revised socioeconomic data set reflecting the changed land use distributions was input to the Transportation Model (see Figure 1-3). In this way, the effects of travel behavior on land-use distributions were assessed.

Figure 1-3: Analysis of Impacts on Land Use



CHAPTER 2: THE REGIONAL TRANSPORTATION MODEL

A. Model Inputs and Assumptions

To produce travel demand forecasts, the Regional Model uses externally developed data. These data include socioeconomic data, transportation networks, Transportation Control Measures, auto operating costs, and transit fares.

1. Socioeconomic Data

Socioeconomic data are used in the trip generation process to estimate person trip productions and attractions. The socioeconomic data projections used in the RTIP Amendment and Regional Mobility Element (RME) evaluations were developed using SCAG'S current growth forecast policy, called the "Regional Growth Management Element" (GME). The GME will be adopted by the SCAG Executive Committee in May, 1994. The GME presents forecasts of population, housing, employment, and land use for the SCAG region and stratified by twenty-five sub-regions.

The 1990 socioeconomic data were taken from the Census, and from estimated employment data, which are controlled to the Employment Development Department (EDD) totals. The socioeconomic data contained in the GME for the years 2000, 2010, and 2015, were disaggregated to the 1,527 Transportation Analysis Zones for input into the Regional Transportation Model.

The travel demand model requires data for the following socioeconomic variables:

- Occupied Single Family Dwelling units (OSDU)
- Occupied Multiple Family Dwelling units (includes group quarters) (OMDU)
- Total dwelling units
- Total population
- Retail employment
- Non-retail employment
- Total employment
- Median household income

For a complete description on the development of socioeconomic data see the 1989 Regional Growth Management Plan. Presented in Table 2-1 is a summary of SCAG's adopted socioeconomic projections used for this study.

Table 2-1: Socioeconomic Data Summary for SCAG Modeling Area

Population				
County	**1990**	**2000**	**2010**	**2015**
Los Angeles	8,859,716	9,950,360	11,285,622	11,936,267
Orange	2,410,533	2,867,593	3,107,312	3,179,917
Riverside	1,170,418	1,850,018	2,554,354	2,938,272
San Bernardino	1,418,364	1,904,482	2,468,257	2,755,024
Ventura	669,010	773,886	871,546	924,455
VCAPCD	669,010	773,886	871,546	924,455

SEDAB	695,406	1,223,170	1,823,751	2,156,986
SCAB	13,001,600	15,147,950	17,331,357	18,372,889
Extended Area	14,366,016	17,145,006	20,026,654	21,454,330
Employment				
County	**1990**	**2000**	**2010**	**2015**
Los Angeles	4,612,814	5,083,972	5,670,135	5,911,636
Orange	1,305,087	1,562,050	1,890,134	2,005,551
Riverside	356,300	516,888	761,798	840,238
San Bernardino	472,001	638,920	888,757	978,002
Ventura	274,999	337,354	410,315	444,350
VCAPCD	274,999	337,354	410,315	444,350
SEDAB	233,270	352,053	502,695	558,782
SCAB	6,469,907	7,440,302	8,611,820	9,107,685
Extended Area	6,978,176	8,124,728	9,514,947	10,110,817

2. Transportation System

Transportation projects from the RTIP Amendment are analyzed using highway and transit networks. These networks are schematic representations of the regional transportation system. Transportation projects are represented in the network by adding capacity, additional lanes, to the base year network which includes those projects that have been already constructed.

a. Highway Networks

The Regional Transportation Model utilizes highway networks which simulate the four basic highway transportation systems: 1) Standard, 2) Two-person carpool, 3) Three-person carpool, and 4) Toll Facilities.

The standard network includes all freeways, major and primary arterials, and sufficient secondary arterials to provide reasonable access from the zone centroids to the major and primary arterials.

The two-person carpool network includes those high occupancy vehicle lanes in the freeway system which permit 2-person occupancy vehicles.

The three-person carpool network includes the El Monte Busway HOV lanes. Only vehicles carrying three or more persons are allowed on this facility

Each highway segment (link) is coded with the following attributes:

- Anode
- Bnode
- Distance
- Number of lanes
- Speed
- Geographic location (RSA)
- Facility type - Freeway, Major arterial, Primary arterial, Secondary arterial, HOV, and zone centroid
- Area type - CBD, Central, Suburban, Mountain and rural

The toll facility network includes the region's five proposed toll facilities. Toll charges were applied to the years 2000, 2010, and 2015 networks.

b. Transit Networks

The transit networks for the RTIP Amendment were developed using the criteria listed below, plus additional information about level of service that is necessary to code the transit networks not required for highway projects.

The transit network is based on a detailed inventory of the public transportation facilities and their level of service and reflect in the 1990 base year network. The NO Build' and 'Build" transit networks were created by adding RTIP Amendment projects to the base year network using the same procedures described above.

The transit levels-of-service depict the morning peak period, the period for which the mode-choice model was calibrated. Major parameters include walk access which range to about 1/2 mile and auto access which range to about 5 miles.

Each transit line has the following attributes:

- Mode (walk access, auto, bus, express bus, and rail)
- Transit Company
- Line Number
- Headways (peak)
- Sequentially linked nodes describing the line

Each transit link has the following attributes:

- Record Identifier
- Anode
- Bnode
- Mode (walk access, auto, bus, express bus, and rail)

- Distance
- Speed (AM Peak Period)
- Time (AM, Peak Period)

c. FY 1993/99 Regional Transportation Improvement Program Amendment

To perform the emissions analysis as required under the Interim Guidance, emissions comparisons were made on five networks which included a 1990 base year and a series of six future year scenarios:

4. Year 1990 'Base Year'
5. Year 2000 'No Build'
6. Year 2000 'Build'
7. Year 2010 'No Build
1. Year 2010 'Build'
8. Year 2015 'No Build'
2. Year 2015 'Build'

The 1990 'Base Year' scenario represents all those projects operational during the Spring of 1990.

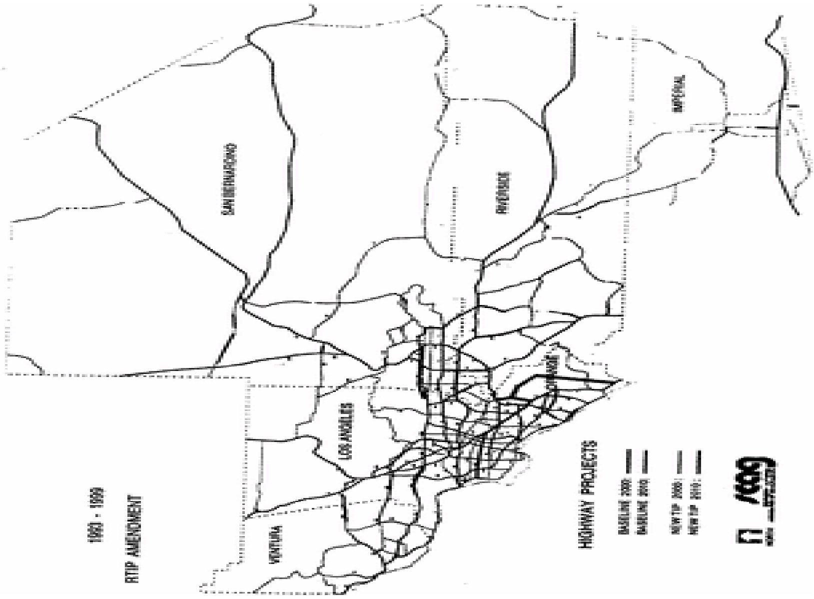
The 'No Build' (Baseline) scenario, according to EPA's Final Transportation

Conformity Ruling sections 51.438(c) and 93.123(c), is defined generally as the future transportation system which include all regionally significant projects, all TDM or TSM activities, and all projects, regardless of funding source, which are currently under construction, or have completed the National Environmental Policy Act (NEPA) process.

The 'Build' (Action) scenario, per sections 51.438(d) and 93.123(d) of the EPA rule, is defined generally as the future transportation system that will result from the implementation of the proposed TIP and those other expected regionally significant projects in the non-attainment area in the time frame of the transportation plan, regardless of the funding sources.

SCAG obtained project descriptions for each of the highway, HOV and transit projects in the FY 1993/1999 RTIP Amendment and reviewed for consistency with the 1994 Regional Mobility Element (RME).

Figure 2-1: RTIP Mix Flow Highway Projects



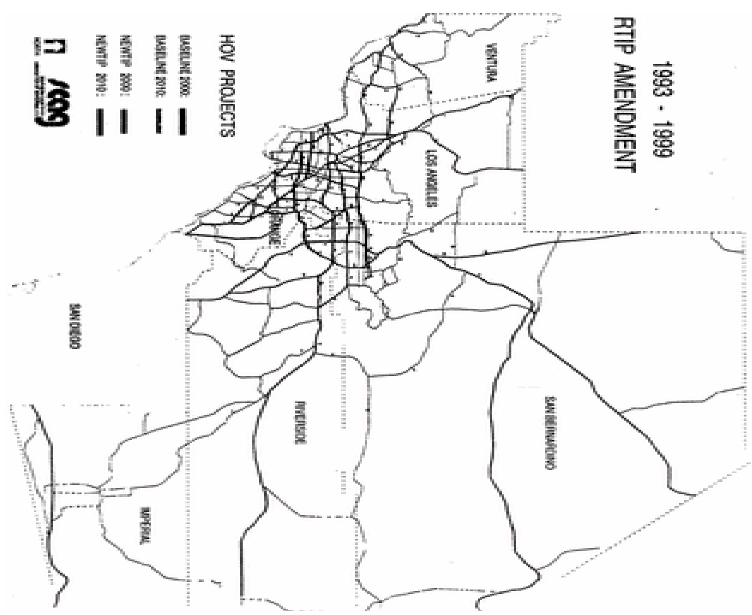


Figure 2-2: RTIP HOV Highway Projects

A summary of the characteristics for the RTIP networks is provided in Table 2-2 by air basin.

Table 2-2: Transportation System Attributes					

VCAPCD Facilities	1990 Base	2000 NB	2000 B	2010/2015 NB	2010/2015 B
Freeway: Lane Miles	478	486	497	486	497
Maj. Arterial: Lane Miles	132	120	125	120	125
Primary: Lane Miles	1,063	1,074	1,083	1,074	1,083
Secondary: Lane Miles	497	496	501	496	501
HOV: Lane Miles	--	--	--	--	--
Transit Rail: Rail Miles	--	31	31	31	31
SEDAB Facilities	1990 Base	2000 NB	2000 B	2010/2015 NB	2010/2015 B
Freeway: Lane Miles	1,034	1,048	1,048	1,048	1,048
Maj. Arterial: Lane Miles	389	415	478	415	478
Primary: Lane Miles	2,159	2,182	2,287	2,182	2,320
Secondary: Lane Miles	2,796	2,811	2,845	2,811	2,845
HOV: Lane Miles	--	--	38	--	38
Transit Rail: Rail Miles	--	8	8	8	78
SCAB Facilities	1990 Base	2000 NB	2000 B	2010/2015 NB	2010/2015 B
Freeway: Lane Miles	6,056	6,472	6,810	6,491	7,141
Maj. Arterial: Lane Miles	4,602	4,790	5,007	4,803	5,027
Primary: Lane Miles	11,026	11,170	11,389	11,181	11,400
Secondary: Lane Miles	4,818	4,853	5,001	4,846	5,020
HOV: Lane Miles	105	389	999	412	1,208
Transit Rail: Rail Miles	--	316	1,150	316	1,197

3. Transportation Demand Management

Demonstration Transportation Demand Management (TDM) strategies submitted by the Los Angeles County Metropolitan Transportation Authority (LACMTA) are included in the RTIP Amendment. The demonstration projects indicate that the trip reduction impacts are more local than regional in nature, until implemented on a wide scale basis. The demonstration projects can be characterized as: vanpool programs, specific extensions to transit services, facilitation actions to encourage ridesharing and transit use by increasing information availability and/or access to alternative transportation modes, providing satellite work centers, providing incentives for commute alternatives to the single-occupant vehicle and facilitating access to amenities to reduce the need for an automobile.

An evaluation of the demonstration project impacts, once implemented, is included as a component of LAMTA's TDM Program. While the ability of the regional transportation model to assess the impacts of highly localized implementation of demand management is limited, the regional model can be used to address the impacts on the transportation system of a widespread, systematic approach to the implementation of demand management strategies (see Table 2-3). Thus an evaluation of demand management strategies is most appropriately performed "off-model" at this time.

Table 2-3: SCAG Regional Toll Facilities

Transportation Corridors	1990	2000 NB	2000 B	2010/2015 NB	2010/2015 B
Route 57; I-5 to I-405	0+0	0+0	0+0	0+0	4 toll only
Route 73 San Joaquin	0+0	0+0	6+0	0+0	6+2
Route 91	8+0	8 MF 4 toll	8 MF 4 toll	8 MF 4 toll	8 MF 4 toll
Route 231 Eastern	0+0	0+0	4+0	0+0	6+2
Route 241 Foothill:					
Eastern to Oso Pkwy	0+0	4+0	4+0	6+2	6+2
Oso Pkwy to I-5	0+0	0+0	4+0	0+0	6+2

4. Transportation Costs

The following two transportation costs are critical elements in the mode choice component of the Regional Model.

a. Auto Operating Costs

There are two components of auto operating cost: the cost of gasoline and 'other' costs. The other category includes costs for repairs, maintenance, lubrication, tires, and accessories. Auto operating costs for the years 1990, 2000, 2010 and 2015 are shown in Table 2-4.

Table 2-4: Auto Operating Costs

Source	1990	2000	2010/2015
Fuel Cost (cents/gallon)	36.32	47.79	57.22
Fuel Economy (miles/gallon)	18.12	21.86	25.60
Other Costs (cents/miles)	2.81	2.81	2.81
Auto Operating Costs (cents/mile)	4.76	4.89	5.05

The 1990 gasoline cost was derived by summing the prices of each grade of gasoline sold in the Los Angeles area weighted by the relative amount that is sold of that grade of gasoline. The price of gasoline by grade was obtained from the California Energy Commission and the market share by grade was from the Lundberg Letter. Future fuel costs (years 2000 and 2010) were estimated using a 2% per annum growth rate applied to the 1990 price of gasoline. For 2015, the gasoline price is assumed to be the same as in 201 0. This method for estimating future fuel costs was developed by CALTRANS District 7 Staff and the Regional Modeling Task Force. Fleet fuel economy figures for the years 1987 and 2010 were provided by the California Air Resources Board. In addition, future year costs (years 2000, 2010, and 2015) include an increase of 18.3 cents due to the Federal Tax increase to balance the budget and implementation of the State gasoline tax increase, Proposition 111. Year 2000 fuel economy levels, needed for the RTIP analysis were calculated by interpolation using the 1987 and 2010 figures. The 'other' costs in real dollars were assumed constant.

NOTE: Costs are expressed in 1967 dollars for input into the mode choice model. Auto Operating costs are calculated using the following formula:

Auto Operating Cost = Fuel Cost/Fuel Economy + Other Costs

b. Transit Fares

In addition to estimating the cost of operating an automobile, the cost of transit must be estimated. Transit fares, Table 2-5, are weighted to reflect:

- Cash fares including the various discounts offered to students and the elderly/disabled
- the use of monthly passes by various fare categories for the initial boarding
- the use of the monthly pass for transferring between buses
- the average effective express zone charge for both cash and pass users

Table 2-5: Transit Fares

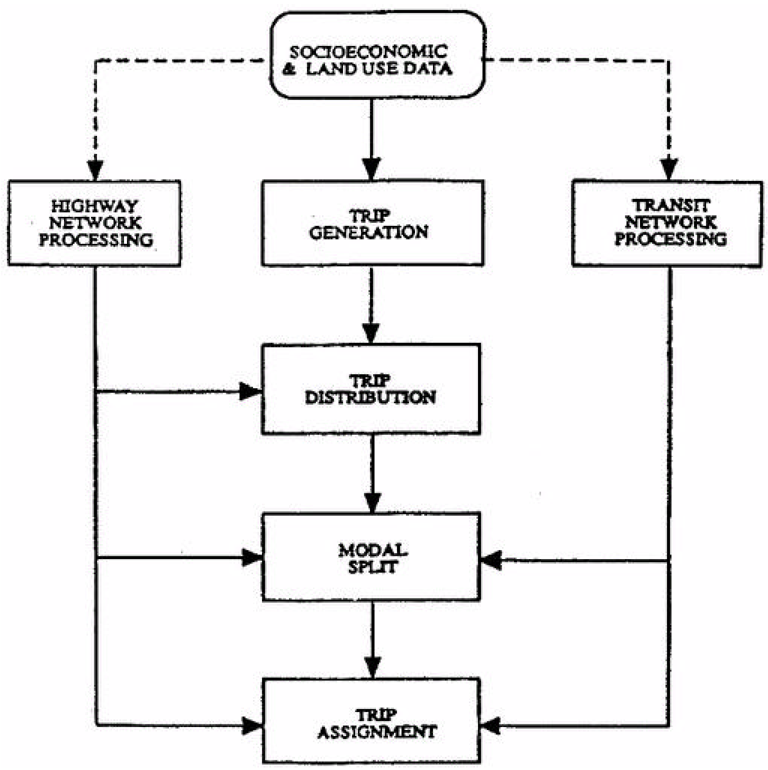
Fares	RTD	OCTD	Others
Base Fare (cents)	64.7 (16.1)	72.0 (17.9)	72.0 (17.94)
Line Haul (cents per mile)	6.8 (1.7)	NA	NA
Transfer (cents per transfer)	29.5 (7.4)	6.0 (1.5)	6.0 (1.5)

Note: XX.X — Transit fare in 1991 dollars
(YY.Y) — Transit fare in 1967ollars

B. Model Description

SCAG's Regional Transportation Modeling System consists of a four step process: trip generation, trip distribution, mode choice, and trip assignment. These four major steps, shown in Figure 2-3, comprise the travel demand forecasting process, which is implemented by utilizing the TRANPLAN transportation planning software package. The following sections briefly describe each of the four modeling processes. See the Appendix (not included in this document), from the 1989 Regional Mobility Plan, for a more detailed description of the model.

Figure 2-3: Regional Transportation Model Structure



1. Modeling Area and Traffic Analysis Zone System

SCAG's modeling area includes all of Los Angeles, Orange, and Ventura counties, and the urbanized portions of western Riverside and San Bernardino counties. For transportation modeling purposes, the area is divided into 1,527 transportation analysis zones (TAZ's) with an additional 28 external cordon stations.

The TAZ's were developed using 1980 census tract boundaries. Zone size varies as a function of the amount of activity (i.e., population, employment and housing) within each zone. In most instances, the TAZ's are aggregates of census tracts, except in the rural areas of the region, where the TAZ's are desegregates of large census tracts.

2. Trip Generation

The trip generation model estimates the number of person trips generated on an average weekday by the residents of each analysis zone. The basic trip decision unit, in each of six categories are estimated through regression equations.

Single dwelling units with:

- no vehicle
- one vehicle, or
- two or more vehicles, and

Multiple dwelling units with:

- no vehicle,
- one vehicle, or
- two or more vehicles

Person trips are generated for the five trip types shown below:

- Home-to-Work
- Home-to-Shop
- Home-to-Other
- Other-to-Work
- Other-to-Other

The trip generation model first uses the socioeconomic data to classify households into these six categories, and then applies trip rates to the cross-classified trip units to estimate the total number of trips "produced" by each zone for each of the five trip types. "Produced" trips differ from “generated” trips in that those trips that are not home-based are “reallocated" to the zone that produces the trip.

The model also uses the socioeconomic data to develop relative attractiveness of each zone for each trip type. After trip generation, the relative attractions for the region are normalized to trip productions for the region as a whole, to obtain actual trip attraction by zone. This ensures that the total number of trips produced are the same as the total number of trips attracted within the region.

Trip generation methodology for Victor Valley was similar to that of the SCAG model. However, the trip generation component for Cochlea Valley generates vehicle trips rather than person trips and addresses the seasonally of traffic fluctuations due to its part-time residents and tourists. The trip generation component is part of the Cochlea Valley Area Transportation Study (CVATS) Model for years 1990 to 2010 and is independent of the TRANPLAN software.

3. Trip Distribution

Methodology

Using the total productions and attractions (P&A) from the previous module, this module distributes the trips by trip type to P&A zone pairs resulting in a 1,555 by 1,555 matrix. In essence, this matrix summarizes the number of trips that go from one zone to another in the region.

The algorithm used to distribute the trips between zones is the gravity model. The model is based on a theory essentially the same as the law of gravity: attraction is proportional to the product of two masses, and inversely proportional to the square of their distance. In travel demand modeling, the two masses are the total produced and attracted trips for a given zone pair; and the square of their distance is represented by 'friction factors" according to the minimum-path travel time between the zones. Friction factors are calculated from 1991 Origin Destination (0-D) Travel Survey data and represent the resistance to making a trip based on the time required to make it.

For the RTIP 93-99 Amendment conformity analysis, an iteration process was used in which the congested time from the initial peak period assignments were used to develop new skim tables (congested times) as input to the trip distribution model.

The resulting zone-to-zone trip tables for the 5 purposes are then combined to three purposes: (1) home-to-work, (2) other-to-work, and (3) non-work, for the next module, mode choice. The diagonals of the Tables 2-6 within-county trips. LA County retains the highest percent of its trips (96.1 % of total productions); Orange and Ventura counties are next highest. Trip retention is enhanced by a county's job- housing balance, its size, and its isolation.

Table 2-6: Person Trip Distribution Summary by County
Year 1990

From/To:	LOS	ORA	RTV	SAN	VEN	Total
LOS	4,917	158	2	36	21	5,134
ORA	377	1,405	4	6	0	1,792
RTV	61	41	303	91	0	496
SAN	141	29	53	389	0	612
VEN	110	0	0	0	328	438
Total	5,506	1,633	362	522	349	8,472

Year 2000 No-Build

From/To:	LOS	ORA	RTV	SAN	VEN	Total
LOS	5,311	168	2	43	32	5,556
ORA	379	1,656	3	4	0	2,042
RTV	204	39	421	98	2	764

SAN	149	23	65	506	1	744
VEN	106	1	0	0	383	490
Total	6,149	1,887	491	651	418	3,596

Year 2000 Build						
From/To:	**LOS**	**ORA**	**RTV**	**SAN**	**VEN**	**Total**
LOS	5,294	177	3	46	35	5,555
ORA	397	1,633	5	7	0	2,042
RTV	165	47	421	130	2	765
SAN	190	34	59	461	1	745
VEN	108	1	0	0	380	489
Total	6,154	1,892	488	644	418	9,596

Year 2010 No-Build						
From/To:	**LOS**	**ORA**	**RTV**	**SAN**	**VEN**	**Total**
LOS	5,811	242	6	101	39	6,199
ORA	348	1,819	10	10	0	2,187
RTV	248	85	605	85	10	1,033
SAN	125	38	75	667	0	905
VEN	76	5	0	1	454	536
Total	6,608	2,189	696	864	503	10,860

Year 2010 Build						
From/To:	**LOS**	**ORA**	**RTV**	**SAN**	**VEN**	**Total**
LOS	5,798	269	7	84	40	6,198
ORA	349	1,825	5	8	0	2,187
RTV	213	69	610	131	2	1,025
SAN	169	29	73	634	0	905
VEN	87	3	0	0	457	547
Total	6,616	2,195	695	857	499	10,862

Year 2015 No-Build						
From/To:	**LOS**	**ORA**	**RTV**	**SAN**	**VEN**	**Total**
LOS	6,078	281	9	137	54	6,559
ORA	367	1,836	21	13	0	2,237
RTV	295	144	668	68	1	1,176
SAN	135	63	71	728	0	997
VEN	66	12	0	1	502	581
Total	6,941	2,336	769	947	557	11,550

Year 2015 Build						
From/To:	**LOS**	**ORA**	**RTV**	**SAN**	**VEN**	**Total**
LOS	6,086	300	10	113	51	6,560
ORA	369	1,855	6	7	0	2,237
RTV	285	133	675	80	1	1,174
SAN	128	43	81	745	0	997
VEN	72	8	0	1	501	582
Total	6,940	2,339	772	946	553	11,550

Year 1990						
From/To:	**LOS**	**ORA**	**RTV**	**SAN**	**VEN**	**Total**
LOS	28,415	680	13	175	80	29,363
ORA	1,010	8,280	14	17	1	9,322
RTV	152	113	2,534	260	0	3,059
SAN	459	79	186	3,215	0	3,939
VEN	373	5	0	1	2,443	2,822
Total	30,409	9,157	2,747	3,668	2,524	48,505

Year 2000 No-Build						
From/To:	**LOS**	**ORA**	**RTV**	**SAN**	**VEN**	**Total**
LOS	31,178	785	11	191	108	32,273

ORA	1,098	9,911	14	16	1	11,040
RTV	453	328	3,589	361	3	4,734
SAN	628	138	230	3,897	1	4,894
VEN	433	10	0	1	2,804	3,248
Total	33,790	11,172	3,844	4,466	2,917	56,189

Year 2000 Build						
From/To:	**LOS**	**ORA**	**RTV**	**SAN**	**VEN**	**Total**
LOS	31,164	779	13	203	114	32,273
ORA	1,103	9,897	18	21	1	11,040
RTV	356	307	3,676	392	2	4,733
SAN	425	137	227	3,905	1	4,895
VEN	408	9	0	1	2,830	3,248
Total	33,656	11,129	3,934	4,522	2,948	56,189

Year 2010 No-Build						
From/To:	**LOS**	**ORA**	**RTV**	**SAN**	**VEN**	**Total**
LOS	32,499	1,023	19	300	146	33,987
ORA	4,067	11,061	23	24	1	12,176
RTV	489	476	5,043	443	1	6,452
SAN	617	189	280	5,016	1	6,103
VEN	399	19	0	2	3,219	3,639
Total	35,071	12,768	5,365	5,785	3,368	62,357

Year 2010 Build						
From/To:	**LOS**	**ORA**	**RTV**	**SAN**	**VEN**	**Total**
LOS	34,284	1,042	20	294	147	35,787
ORA	1,067	11,065	19	24	1	12,176
RTV	444	501	5,027	480	2	6,454
SAN	674	186	276	4,963	1	6,100

VEN	410	16	0	2	3,212	3,640
Total	36,879	12,810	5,342	5,763	3,363	64,157

Year 2015 No-Build						
From/To:	**LOS**	**ORA**	**RTV**	**SAN**	**VEN**	**Total**
LOS	36,129	1,095	23	339	199	37,785
ORA	1,101	11,356	34	27	1	12,519
RTV	591	644	5,678	468	1	7,382
SAN	689	247	300	5,439	1	6,676
VEN	384	25	1	2	3,522	3,934
Total	38,894	13,367	6,036	6,275	3,724	68,296

Year 2015 Build						
From/To:	**LOS**	**ORA**	**RTV**	**SAN**	**VEN**	**Total**
LOS	36,134	1,105	24	327	195	37,785
ORA	1,101	11,373	21	23	1	12,519
RTV	568	677	5,664	471	2	7,382
SAN	698	231	308	5,437	1	6,675
VEN	390	20	1	2	3,522	3,935
Total	38,891	13,406	6,018	6,260	3,721	68,296

4. Mode Choice

Based on the zone-to-zone trip table for home-to-work person trips, the mode choice model determines which of the four modes a commuter will choose:

- Drive alone
- Two-person carpool
- Three-or-more person carpool
- Public transit

The mode choice model is a hybrid model which includes three sub-models which were developed over a number of years by several consulting firms. The three model are applied in a sequence of steps to allocate person trips to the various modes:

Step 1. Allocate person trips to auto and transit modes - binary choice model (Alan M. Voorhees and Associates).

Step 2. Allocate the auto trips to drive alone and shared ride vehicle modes - shared ride model (Cambridge Systematics, Inc.).

Step 3. Allocate the shared ride, vehicle trips to two occupancy vehicle modes - carpool model (Barton-Aschman Associates).

Once the mode split is calculated for home-work trips, factors applied to other-work and non-work person trips allow estimation of daily transit trips and vehicle trips. The results of mode split are shown in Table 2-7.

Table 2-7: Mode Split Summary for SCAG Region

Home-Work	**1990**	**2000NB**	**2000B**	**2010NB**	**2010B**	**2015NB**	**2015B**
Drive Alone	8,405 75.58%	6,701 59.83%	6,623 69.02%	7,534 69.35%	7,397 68.09%	7,962 48.94%	7,782 67.38%
Shared Ride	1,593 18.80%	2,064 21.51%	2,119 22.08%	2,454 22.59%	2,524 23.23%	2,649 22.94%	2,733 23.66%
SUM	8,474 100%	9,516 100%	9,596 100%	10,863 100%	10,863 100%	11,550 100%	11,550 100%
Veh-Occupancy	1.129	1.157	1.163	1.166	1.172	1.170	1.178
All Trips	**1990**	**2000NB**	**2000B**	**2010NB**	**2010B**	**2015NB**	**2015B**
Veh-Driver	34,032 70.16%	38,918 69.26%	38,864 69.17%	44,450 69.28%	44,342 69.11%	47,173 69.07%	47,045 59.88%
Veh-Passenger	13,409 27.64%	15,724 27.89%	15,758 28.04%	18,056 28.14%	18,038 28.19%	19,225 28.15%	19,263 28.21%
Transit	1,064 2.19%	1,547 2.75%	1,549 2.79%	1,651 2.67%	1,727 2.69%	1,898 2.78%	1,988 2.91%
Sum	48,505 100%	56,189 100%	56,189 100%	64,157 100%	64,157 100%	68,296 100%	68,296 100%
Veh-Occupancy	1.394	1.404	1.405	1.406	1.408	1.408	1.409

Notes: NB = No Build   B = Build

The results shown in Table 2-7 includes the utilization of the congested highway and transit skims.

5. Trip Assignment

The last step before highway trip assignment is conversion of vehicle trips from production-attraction trips to origin-destination trips by trip type and by time-of-day. This conversion tells us the direction of the trip so that the trip can be assigned to the transportation system. Based on data from the 1 991 Origin Destination Travel Survey, morning (6:00 am to 9:00 am) and evening (3:00 pm to 7:00 pm) peak periods, and two off-peak periods: mid-day (9:00 am to 3:00 pm) and night (7:00 pm to 6:00 am), have been identified. Table 2-8A below details the peak-period factors for vehicle-driver trips by direction of travel.

Table 2-8A: Vehicle Driver Trip Factors for SCAG Region
Based on the 1991 O/D Survey

Period	Direction[1]	Home to Work	Other to Work[2]	Non-Work
AM Peak (6:00am-9:00am)	P to A A to P	0.3403 0.0152	0.1492 0.0166	0.1178 0.0168
Midday (9:00am-3:00pm)	P to A A to P	0.0786 0.0594	0.2199 0.2199	0.2665 0.1050
PM Peak (3:00pm-7:00pm)	P to A A to P	0.0196 0.3215	0.0343 0.3089	0.1643 0.1476
Night (7:00pm-6:00am)	P to A A to P	0.0944 0.0710	0.0256 0.0256	0.0698 0.1122
Daily Total		1.0000	1.0000	1.0000

Notes:
[1] Direction: P to A = Origin (Production Zone) to destination (Attraction Zone); and
A to P = Destination to origin.
[2] Other Work trips are 90/10 split for AM peak, 10/90 for PM peak, and 50/50 for Midday and Night periods.

Table 2-8B: Vehicle Driver Trip Factors for Cochlea Valley
Peak Period Factors for External (Cordon) Trips

Period	Internal Zone to Cordon	Cordon to Internal Zone
AM Peak	0.2030	0.0457
Midday	0.4452	0.2523
PM Peak	0.1686	0.4723
Night	0.1832	0.2297
Daily Total	1.0000	1.0000

The SCAG modeling area was expanded to include Victor Valley and Cochlea Valley in the highway assignment process so that emissions by air basins may be analyzed. Highway networks and vehicle trip tables for the extended area were obtained from the SCAG's Riverside office. Vehicle trip tables for Victor Valley were stripped off from the High Desert Corridor model output. Same peak-period factors, as used in the original SCAG modeling area, were applied. The vehicle trip table for Cochlea Valley, already a origin-destination oriented trip table, was generated from the CVATS model. Due to the unique travel characteristics in the Cochlea Valley area, different peak period factors were developed and are shown in Table 2-8B. These trip tables in the extended area were then merged into the SCAG's trip table for each time period, expanding the number of zones from 1,555 to 2,069. Highway networks from the extended area were also merged into the SCAG's network and zones were renumbered the same way as for the trip tables.

Period	O/D Vehicle Trips
AM Peak (6:00am-9:00am)	0.161
Midday (9:00am-3:00pm)	0.484
PM Peak (3:00pm-7:00pm)	0.244
Night (7:00pm-6:00am)	0.111
Daily Total	1.000

Vehicle trip assignment results in representative traffic volumes and average speeds on each link of the peak and off-peak highway networks, in the AM, PM, MIDDAY and Night periods. Night period vehicle trips are assigned using the probabilistic multi-path (stochastic) assignment technique. For trip assignments of the two peak and midday periods, SCAG utilizes the equilibrium assignment algorithm logic in the UROAD program of UTPS and TRANPLAN to take into account congestion by employing a capacity-restrained iterative assignment process.

This equilibrium assignment technique adjusts link time for each iteration based on the volume to capacity ratio (V/C) using the BPR formula (developed by the Bureau of Public Roads) as shown in this illustration.

$$T = T_o * (1.0 + 0.15 * (V/SV) ** 4)$$

where,

T = Estimated link time at volume V

T_o = Free flow time

V = Link volume
SV = NL * C * 0.75
= Service volume of link at level of service c.
where,
NL = Number of lanes on link
C = Maximum capacity

The effects of the toll costs on the five toll facilities were incorporated into the highway assignment. The cost of the toll were added to each toll facility by inserting the cost to the appropriate links and identifying the link with a unique Toll Class number. The toll model converts the cost (in dollars) to a time value with a variable CTOLL, which is expressed in hours per dollar, and is approximately the reciprocal of the value-of-time.

The toll model which was used for this conformity analysis is similar to the toll model that is in the UTPS UROAD, but the TRANPLAN version provides for some accounting of information regarding the toll links. In general, the equation used to calculate impedance for non-toll and for the toll links are shown below:

1) IMPEDANCE = CTIME * T + CDIST * D (for non-toll links)

2) IMPEDANCE = CTIME * T + CTOLL * L (for toll links)

where:
T = Travel time on the link In hours.
D = Link distance in miles.
L = The toll on the link In dollars.
CTIME = rime coefficient In minutes per hour.
CDIST = Distance coefficient in minutes per mile.
CTOLL = Toll charges in hours per dollars.

Note: The above equations 1) and 2) used to calculate impedance are mutually exclusive. Also links identified as toll links are not adjusted for congestion. Therefore, links coded with toll costs were created with a distance of 0.01 mile.

For the RTIP 93-99 Amendment conformity analysis, CDIST = 0, CTOLL = 0.07, and CTIME = 0.60. The value of CTOLL which is approximately the reciprocal of value-of-time, was estimated as shown below:

value-of-time = $32,000/1800 hours (productive hrs in a year) * 0.8
= $14.22/hour or approximately $14 per hour

CTOLL = 1/value-of-time = 1/14 = 0.0714 or approximately 0.07 hr/dollar.

The value-of-time was estimated as a function of a wage earners income. The estimated average annual wage of $32,000, in 1991 dollars, was derived by taking the mean median household Income and dividing by the average mean workers per household and converting that to 1991 dollars by a factor of 4.017. The median household income (in 1967 dollars) and the average workers per household data were obtained from the 2000 socioeconomic data file for the zones in the RSAs within access of the transportation corridors. The conversion factor of 4.017 was based on the CPI value used for the LA-Long Beach area for 1967 was 35.2 and for 1991 was 141.4.

The cost to travel the five toll road facilities were provided by the toll road operators. The five toll roads, San Joaquin Hills Transportation Corridor (SJHTC), Foothill Transportation Corridor (FTC), Eastern Transportation Corridor (ETC), and the State Routes 57 and 91 (SR-57 and SR-91) cost values, in 1991 dollars, were coded in the 2000 and 2010 highway networks as shown below:

Maximum Toll Costs Applied in Network (1991 dollars)			
Corridor	**Year**	**Peak Period**	**Off-peak period**
SR-57	2010	$4.00	$1.50
SR-91	2000	$2.90	$0.70
SR-91	2010	$3.38	$1.45
SJHTC	2000-2010	$0.15/mi.	$0.75/mi.
FTC	2000-2010	$0.15/mi.	$0.75/mi.
ETC	2000-2010	$0.15/mi	$0.75/mi.

A 50 percent discount was applied to vehicles with 2 or more persons where separate HOV lane were not constructed. The 2 or more persons were identified using the same mode split procedures as described in the mode split model. During the highway assignment phase only carpool vehicles (2 or more persons) were allowed on the toll links identified for car-poolers. Single occupancy vehicles were not allowed to travel on those toll links and were required to travel on the roadway with higher toll costs where applicable.

Highway assignments were made separately for the AM peak, PM peak, midday and night periods using the expanded networks and trip tables. Daily totals are obtained by adding the results from the four time periods. Results of vehicle trip assignments, include inter and intrazonal trips, are summarized and are given in following Tables 2-9 and 2-10.

SCAB	1990	2000NB	2000B	2010NB	2010B	2015NB	2015B
Veh-Trips	5,763	6,406	6,391	7,250	7,241	7,615	7,627
VMT	52,555	64,845	63,618	74,333	73,037	81,941	78,153
VHT	1,816	2,727	2,278	4,007	3,004	5,831	3,557
Delay	587	1,236	825	2,285	1,341	3,927	1,776
Avg Speed (mph)	28.94	23.78	27.93	18.55	24.31	14.05	21.97

VCAPCD	1990	2000NB	2000B	2010NB	2010B	2015NB	2015B
Veh-Trips	363	412	412	463	463	499	500
VMT	2,733	3,284	3,231	3,767	3,629	4,226	3,994
VHT	79	100	95	121	113	143	128
Delay	15	24	21	33	28	44	34
Avg Speed (mph)	34.65	32.94	34.01	31.16	32.12	29.54	31.20

SEDAB	1990	2000NB	2000B	2010NB	2010B	2015NB	2015B
Veh-Trips	325	535	520	752	724	896	871
VMT	3,579	6,281	5,949	9,615	8,195	11,814	10,530
VHT	93	213	176	440	266	751	425
Delay	12	68	40	213	75	467	173
Avg Speed (mph)	38.60	29.51	33.80	21.85	30.81	15.74	24.78

TOTAL	1990	2000NB	2000B	2010NB	2010B	2015NB	2015B
Veh-Trips	6,452	7,343	7,323	8,465	8,427	9,045	8,998
VMT	58,867	74,410	72,798	87,716	84,860	97,981	92,677
VHT	1,988	3,040	2,544	4,568	3,383	6,725	4,110
Delay	614	1,328	886	2,531	1,445	4,438	1,983
Avg Speed (mph)	29.62	24.48	28.62	19.20	25.08	14.57	22.55

Table 2-9: Vehicle Trip Summary by Air Basin AM Peak

SCAB	1990	2000NB	2000B	2010NB	2010B	2015NB	2015B
Veh-Trips	31,586	35,764	35,702	40,569	40,519	42,822	42,750
VMT	259,725	330,337	322,436	381,985	378,941	418,884	408,953
VHT	8,171	11,976	10,481	17,090	14,225	23,094	16,945
Delay	2,048	4,372	3,102	8,270	5,592	13,422	7,638
Avg Speed (mph)	31.79	27.58	30.76	22.35	26.64	18.14	24.13

VCAPCD	1990	2000NB	2000B	2010NB	2010B	2015NB	2015B
Veh-Trips	1,957	2,257	2,265	2,571	2,569	2,802	2,803
VMT (000s)	14,369	17,874	17,508	20,544	20,336	22,892	22,388
VHT (000s)	399	525	504	649	626	773	725
Delay (000s)	62	112	99	172	154	239	203
Avg Speed (mph)	36.00	34.03	34.74	31.63	32.49	29.60	30.88

SEDAB	1990	2000NB	2000B	2010NB	2010B	2015NB	2015B
Veh-Trips	1,747	2,806	2,809	4,046	3,991	4,841	3,333
VMT	20,075	34,410	33,186	50,308	46,389	61,639	57,587
VHT	490	1,019	920	2,015	1,516	3,262	2,258
Delay	42	233	164	841	445	1,810	909
Avg Speed (mph)	40.95	33.77	36.07	24.97	30.60	18.90	25.50

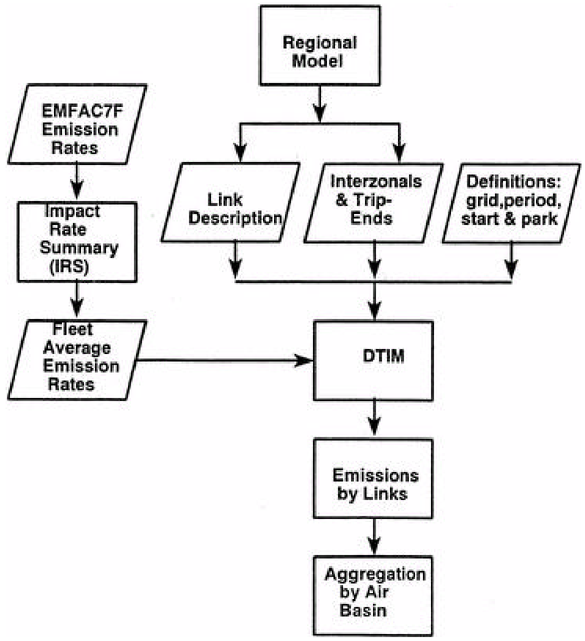
TOTAL	1990	2000NB	2000B	2010NB	2010B	2015NB	2015B
Veh-Trips	35,290	40,829	40,775	47,187	47,079	50,466	48,886
VMT	294,169	382,622	372,912	452,837	445,666	503,414	488,929
VHT	9,060	13,519	11,905	19,754	16,367	27,129	19,928
Delay	2,152	4,718	3,364	9,283	6,191	15,472	8,749
Avg Speed (mph)	32.47	28.30	31.32	22.92	27.23	18.56	24.53

Table 2-10: Vehicle Trip Summary by Air Basin Daily Total

CHAPTER 3: EMISSIONS ANALYSIS

Mobile source emissions are determined using the standard California mobile source emission estimation method. The method Involves the application of two models which are the product of a long-term, joint effort by the California Air Resources Board (ARB) and Caltrans. Currently, ARB is responsible for the emission factors (EMFAC) model and Caltrans is responsible for the development and maintenance of the Direct Travel Impact Model (DTIM). Figure 3-1 shows a flow chart of the DTIM Model process.

Figure 3-1: Emission Model Structure SCAG Land-Use/Transportation Modeling



A. Emission Factors

The ARB maintains the EMFAC model that is used to calculate the emission factors for individual vehicle types and fleets of vehicles. An emission factor is an estimate of the rate at which a pollutant enters the atmosphere per unit of activity (e.g. miles driven, VMT). For the most part, exhaust emission factors are expressed in grams per trip end and per hour of travel. These factors are a function of several variables including fleet age distribution, vehicle engine temperature, ambient temperature, fleet mix, and vehicle speed. An example of one set of running emission factors, for an ambient temperature of 75 IF and for speeds ranging from 5 to 65 mph, is shown in Table 3-1.

The emissions analysis performed on the FY 1993/99 RTIP Amendment used EMFAC7Fl.l.

(Based on Fleet Mix = 74.1% LDA, 19.6% LDT, 5.7% MDT, .6% MCY)

°F	mph	TOG	CO	NOX	PT	FUEL
75	5	2.13	36.44	2.96	1.05	0.20
75	10	2.11	42.57	4.43	2.09	0.39
75	15	2.20	43.91	5.31	3.14	0.59
75	20	2.46	44.86	5.90	4.19	0.78
75	25	2.81	46.10	6.48	5.24	0.98
75	30	3.14	47.60	7.33	6.29	1.17
75	35	3.32	49.47	8.73	7.34	1.37
75	40	3.35	52.25	10.97	8.39	1.56
75	45	3.31	57.24	14.33	9.43	1.76
75	50	3.38	67.00	19.10	10.48	1.95
75	55	3.84	87.28	25.59	11.53	2.15
75	60	5.46	134.04	34.13	12.57	2.34
75	65	12.14	264.60	45.10	13.62	2.54

Notes:
LDA = Light duty autos LDT = Light duty trucks
MDT = Medium duty trucks MCY = Motorcycles
TOG = Total Organic Gases CO = Carbon Monoxide
NOX = Nitrogen Oxides PT = Particulates

Table 3-1: Emission Factors from EMFAC7Fl.l

B. The Direct Travel Impact Model

The Direct Travel Impact Model (DTIM) developed by Caltrans in the late 1970's is used in the State of California to calculate amounts of air pollutant emitted from motor vehicles and fuel consumption. The DTIM analysis is based on travel data produced by the Regional Transportation Model and on emission factors from the EMFAC Model. Input from the Regional model includes highway link information (volume, distance and congestion speed), trip end information (number of start and soak), and intrazonal trip information (number of trips, distance and speed). The Model generates the spatial distribution of running emissions produced from travel on each link and trip end emissions in each zone for each pollutant. It can be summarized by (5 km x 5 km) grid cells and input to the SCAQMD's air quality model. Output from the DTIM is generally summarized by RSA, county, and by air basin.

C. PM-10 Emission Analysis

Background

In the work program for the 1993-1999 RTIP Amendment, SCAG agreed to develop a new method to estimate PM-10 emissions at the request of Region 9, EPA. SCAG decided to use the emission factors and the empirical equation according to AP-42, Compilation of Air Pollutant Emission Factors-vol.l: Stationary Point and the Area Sources, 4th ed., September 1985.

Re-entrainment of wind-blown and tracked dust by vehicles is a major source of dust from, paved urban roads. Additional particulates are directly emitted by vehicles (for example, from engine exhaust and tire abrasion).

Emission Factor Calculation

According to AP-42 (Compilation of Air Pollutant Emission Factors vol.1: Stationary Point and the Area Sources, 4th ed., Sept 85) the quantity of dust emissions by vehicle traffic can be estimated for paved roads using the empirically derived equation:

$$E = k \left[\frac{sL}{0.7}\right]^{y}$$

where:

E	=	particulate emission factor in pounds per vehicle mile traveled (lb/NMT).
k	=	base emission factor (lb/VMT).
sL	=	surface silt loading (gr/ft2).
p	=	particle size range exponent (dimensionless).

PM-10 Emissions Estimation

Taking the base emission factor and exponent parameter from AP-42, Table 1 1. 2.5-3, for PM-10 (particle size fraction less than or equal to 10 microns), equation 1 becomes:

$$E_{PM10} = 0.0081\left[\frac{sL}{0.7}\right]^{0.1}$$

By inserting the mean silt loadings given in AP-42 Table 11.2.5-3 for the various "roadway categories into equation 2 yields the emission for SCAG's Facility Types as presented in Table 3-2.

Table 3-2: Summary of PM10 Emission Factors by Facility Type

FACILITY TYPE(S)*	sL (g/m²)	sL (gr/ft²)
1,5	0.022	0.0315
2,3	0.36	0.5161
4	1.41	2.0215
6	0.92	1.3190

1 = freeway, 2 = major arterials, 3 = primary arterials
4 = secondary arterials (local streets), 5 = HOV
6 = collector streets

Unit conversions: g/m² x 1.4337 = grains/ft².
lb/VMT * 453.6 = g/VMT.

It should be noted that AP-42 does not include any samples from the SCAG region and that the document warns that it is possible that the location (St. Louis) for the freeway silt loading factor may not be representative of areas in the southwest. Significant variation in silt loading is known to be caused by differences in land use and, in particular, differences in climate.

SCAG is using the emission factors given in Table 3-2 for the estimation of PM-10 until local silt loading factor(s) become available from EPA.

D. Mobile Source Emissions Summary

Outputs of the Direct Travel Impact Model (DTIM) are summarized in Tables 3-3 through 3-5 for 1990, 2000 No-Build, 2000 Build, 201 0 No-Build, 201 0 Build, 2015 No-Build and 2015 Build. Light and medium duty vehicle emission results are from the DTIM. However, emissions for the heavy duty vehicles are estimated based on the ratio of heavy duty vehicles over the light duty and medium vehicles from the Air Resources Board's (ARB) Burden Model.

TABLE III-3
EMISSION SUMMARY[1] BY AIR BASINS
LDV and MDV Emissions Using EMFAC-7F1.1 (Emissions in tons/day)

SCAB		ROG	CO	NOx	PM10[2]
1990	LDV + MDV	551.7	3,584.6	398.8	640.6
	HDV	60.9	594.7	300.7	
	TOTAL	612.6	4,179.3	699.5	
1994NB[3]	LDV + MDV			316.8	
	HDV			268.6	
	TOTAL			585.4	
1994 B[3]	LDV + MDV			314.8	
	HDV			268.6	
	TOTAL			583.4	
1995NB[4]	LDV + MDV		2,578.8		
	HDV		405.0		
	TOTAL		2,983.8		
1995 B[4]	LDV + MDV		2,526.7		
	HDV		405.0		
	TOTAL		2,931.7		
1996NB[4]	LDV + MDV	336.7		272.3	
	HDV	44.2		245.8	
	TOTAL	380.9		518.1	
1996 B[4]	LDV + MDV	317.8		272.1	
	HDV	44.2		245.8	
	TOTAL	362.0		517.9	
2000NB[5]	LDV + MDV	294.1	1,930.0	259.0	789.4
	HDV	40.6	287.0	233.4	
	TOTAL	334.7	2,217.0	492.4	
2000 B[5]	LDV + MDV	275.3	1,856.6	258.6	761.9
	HDV	40.6	287.0	233.4	
	TOTAL	315.9	2,143.6	492.0	
2010NB[5,6]	LDV + MDV	151.3	1,217.7	173.0	936.5
	HDV	24.1	285.3	107.4	
	TOTAL	175.4	1,503.0	280.4	
2010 B[5,6]	LDV + MDV	133.3	1,133.4	172.1	897.0
	HDV	24.1	285.3	107.4	
	TOTAL	157.4	1,418.7	279.5	
2015NB[5,6]	LDV + MDV	114.5	1,011.8	134.9	1,036.8
	HDV	5.5	328.9	40.2	
	TOTAL	120.0	1,340.7	175.1	
2015 B[5,6]	LDV + MDV	89.9	866.8	127.8	975.5
	HDV	5.5	328.9	40.2	
	TOTAL	95.4	1,195.7	168.0	

Notes: B = Build NB = No Build

1 Credit for enhanced I/M is not included.
2 Calculation based on AP-42 Compilation of Air Pollutant Emission Factors Vol. 1, September 1985.
3 Assumes no VMT growth between 1990 and 1994.
4 Using emissions per VMT and straight line interpolation of VMT between 1994 and 2000.
5 Heavy Duty Vehicle (HDV) emissions reduced for FIP (10% NOx, 7% ROG for 2000; 65% NOx, 53% ROG for 2010; 88% NOx, 91% ROG for 2015).
6 Light and Medium Duty Vehicle (LDV + MDV) emissions reduced for ZEVs (9% for 2010; 39.4% for 2015).

TABLE III-4

EMISSION SUMMARY[1] BY AIR BASINS

.DV and MDV Emissions Using EMFAC-7F1.1 (Emissions in tons/day)

SCCAB (VCAPCD)		ROG	NOx
1990	LDV + MDV	30.6	23.7
	HDV	2.6	12.1
	TOTAL	33.2	35.8
1996NB[2]	LDV + MDV	17.9	15.8
	HDV	1.9	10.0
	TOTAL	18.8	25.8
1996 B[2]	LDV + MDV	17.7	15.7
	HDV	1.9	10.0
	TOTAL	19.6	25.7
2000NB[2]	LDV + MDV	15.3	14.9
	HDV	1.7	9.8
	TOTAL	17.0	24.7
2000 B[2]	LDV + MDV	15.2	14.8
	HDV	1.7	9.8
	TOTAL	16.9	24.6
2005NB[2,4]	LDV + MDV	11.1	12.2
	HDV	1.8	7.4
	TOTAL	12.9	19.6
2005 B[2,4]	LDV + MDV	11.0	12.1
	HDV	1.8	7.4
	TOTAL	12.8	19.5
2010NB[2,5]	LDV + MDV	6.9	9.6
	HDV	1.1	4.4
	TOTAL	8.0	14.0
2010 B[2,5]	LDV + MDV	6.8	9.5
	HDV	1.1	4.4
	TOTAL	7.9	13.9
2015NB[2,5]	LDV + MDV	4.7	7.2
	HDV	0.2	1.2
	TOTAL	4.9	8.4
2015 B[2,4]	LDV + MDV	4.6	7.1
	HDV	0.2	1.2
	TOTAL	4.8	8.3

Notes: B = Build NB = No Build

1 Credit for enhanced I/M is not included.

2 Using emissions per VMT and straight line interpolation of VMT between 1990 and 2000. (Assumes no VMT growth between 1990 and 1994). Emissions adjusted to the 2000 population forecast by SCAG's 4/1/94 Socio-Economic data.

3 Heavy Duty Vehicle (HDV) emissions reduced for FIP (10% NOx, 7% ROG for 2000; 65% NOx, 53% ROG for 2010; 88% NOx, 91% ROG for 2015).

4 Straight line interpolation between 2000 and 2010.

5 Light and Medium Duty Vehicle (LDV + MDV) emissions reduced for ZEVs (9% for 2010; 29.4% for 2015).

TABLE III-5
EMISSION SUMMARY[1] BY AIR BASINS
LDV and MDV Emissions Using EMFAC-7F1.1 (Emissions in tons/day)

SEDAB		ROG	NOx	PM10[2]
1990	LDV + MDV	38.6	33.6	67.5
	HDV	4.8	29.7	
	TOTAL	43.4	63.3	
1996NB[3]	LDV + MDV	30.8	29.9	
	HDV	4.1	29.6	
	TOTAL	34.9	59.5	
1996 B[3]	LDV + MDV	29.5	29.4	
	HDV	4.1	29.6	
	TOTAL	33.6	59.0	
2000NB[4]	LDV + MDV	27.5	29.3	122.6
	HDV	3.7	28.4	
	TOTAL	31.2	57.7	
2000 B[4]	LDV + MDV	26.2	28.7	117.7
	HDV	3.7	28.4	
	TOTAL	29.9	57.1	
2007NB[4,5]	LDV + MDV	20.9	25.5	170.9
	HDV	3.1	17.7	
	TOTAL	24.0	43.2	
2007 B[4,5]	LDV + MDV	18.3	24.2	156.4
	HDV	3.1	17.7	
	TOTAL	21.4	41.9	
2010NB[4,6]	LDV + MDV	18.1	23.8	191.7
	HDV	2.2	12.8	
	TOTAL	20.3	36.6	
2010 B[4,6]	LDV + MDV	14.9	22.2	173.0
	HDV	2.2	12.8	
	TOTAL	17.1	35.0	
2015NB[4,6]	LDV + MDV	16.1	20.6	243.4
	HDV	0.6	5.5	
	TOTAL	16.7	26.1	
2015 B[4,6]	LDV + MDV	11.9	18.6	223.4
	HDV	0.6	5.5	
	TOTAL	12.5	24.1	

Notes: B = Build NB = No Build
1 Credit for enhanced I/M is not included.
2 Calculation based on AP-42 Compilation of Air Pollutant Emission Factors Vol. 1, September 1985.
3 Using emissions per VMT and straight line interpolation of VMT between 1990 and 2000.
4 Heavy Duty Vehicle (HDV) emissions reduced for FIP (10% NOx, 7% ROG for 2000; 65% NOx, 53% ROG for 2010; 88% NOx, 91% ROG for 2015).
5 Straight line interpolation between 2000 and 2010.
6 Light and Medium Duty Vehicle (LDV + MDV) emissions reduced for ZEVs (9% for 2010; 29.4% for 2015).

CHAPTER 4: THE DRAM/EMPAL LAND USE MODEL

As part of the analysis of the RTIP, SCAG has endeavored to look at the potential land use impacts of network changes associated with the defined transportation improvements. Previous SCAG analyses had relied on a constant socioeconomic base to generate an estimate of mobile source emissions.

This analysis provides a new dimension to the RTIP analysis by looking at the impact that congested travel times may have on regional development patterns. To perform this analysis, SCAG relies upon the DRAM/EMPAL modeling system, which has been under development since 1976.

The following section briefly describes the DRAM/EMPAL model and the methodology SCAG utilized to perform this analysis. A more detailed description of the DRAM/EMPAL model is provided in Appendix 5-B. Other sections will then compare the land use and emissions output from model runs using the two land use scenarios.

A. Model Description

DRAM" (Disaggregated Residential Allocation Model) ,and EMPAC (Employment Allocation Model) are two spatial interaction models, designed to project small area distributions of employment and housing. The models are state of the art urban location models based on aggregate reformulations of location choice models. The models have been applied in numerous metropolitan areas in the U.S. and abroad. Currently many of the major Metropolitan Planning Organizations (MPOs) in the U.S. are in various stages of utilizing the model for transportation related analysis and modeling.

SCAG began the installation of the model for the Southern California region in conjunction with Caltrans in 1986. The model has been installed and calibrated in consultation with Stephen Putman, and extensive sensitivity analyses have been performed for all of the model parameters.

While the model considers a wide variety of variables in determining urban locations, a crucial assumption of the model is that activities (employment and households) are complex nonlinear functions of accessibility to other activities. Travel times to labor or consumer markets, or to place of work thus become important variables for urban location in the model's equations.

Because of the sensitivity to congestion and relative travel times, the model may be used to examine the potential effects on land use from transportation related improvements. It was largely to facilitate such second order testing of transportation planning assumptions that the model was developed. For this analysis, the central assumption is that changes in transportation facilities which result in significant changes in relative travel times will, over time, have a corresponding impact on the future distribution of employment and residential locations.

B. Methodology

The DRAM/EMPAL model does not, strictly speaking, produce future forecasts for the region. Instead, it relies on exogenously supplied regional totals of future years for employment and households, which the model then dis-aggregates to small areas. The model was supplied with the regional totals from the forecasts done in 1994, every five years from 1995 to 2010. The model was calibrated to reflect actual 1990 base year data, taken from the census and from estimated employment by location, which was described earlier.
The purposes of the analysis are to gauge the travel time differences associated with the implementation of new transportation facilities, and the resultant land use changes, and to measure the trips generated and relative congestion levels on the network due to the suggested land use location changes. For these purposes, the model was run in an interactive fashion with the transportation TRANPLAN model in five year increments to the year 2010. This is done for each of the two scenarios - the congested travel times of the build, and those of the no build network scenarios.

Each EMPAL-DRAM-TRANPLAN five-year run actually involved several cycles in order to reach convergence (equilibrium) and stability of model results. To achieve this solution, the method of successive -average (MSA) algorithm was used to combine transportation link volumes of each pair of successive cycles. Based on the averaged link flow, new travel times are then calculated for next iteration. The MSA algorithm averaged link volumes of successive cycles by weighing volumes more on prior iteration than on the later iteration, and increasing the weighing difference as cycles add up. For this analysis, three cycles were conducted for the first five-year run, and two cycles for the rest of the five-year increments. Figures 4-1 through 4-4 illustrate the iteration processes for each of the five-year increments.

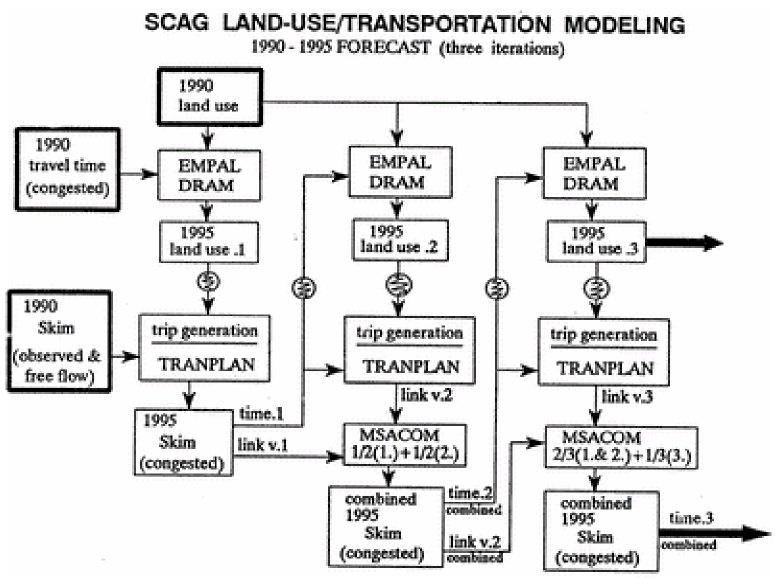


Figure 4-1: 1990-1995

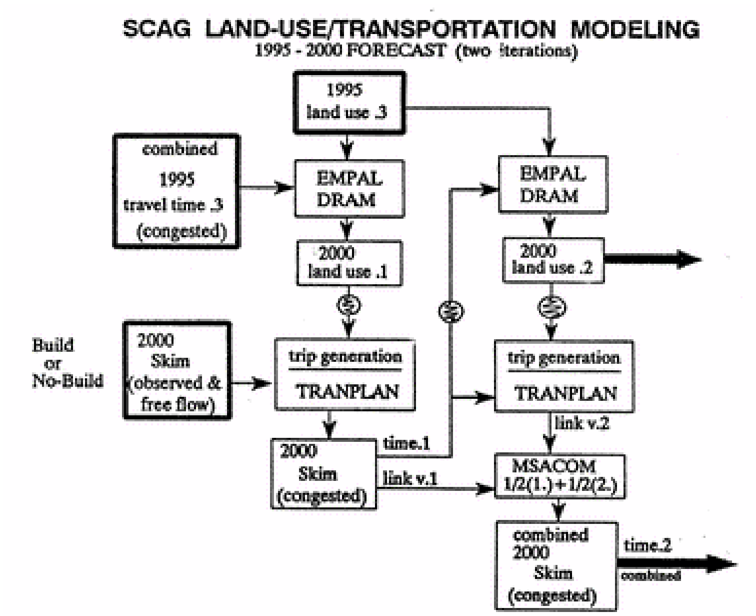


Figure 4-2: 1995-2000

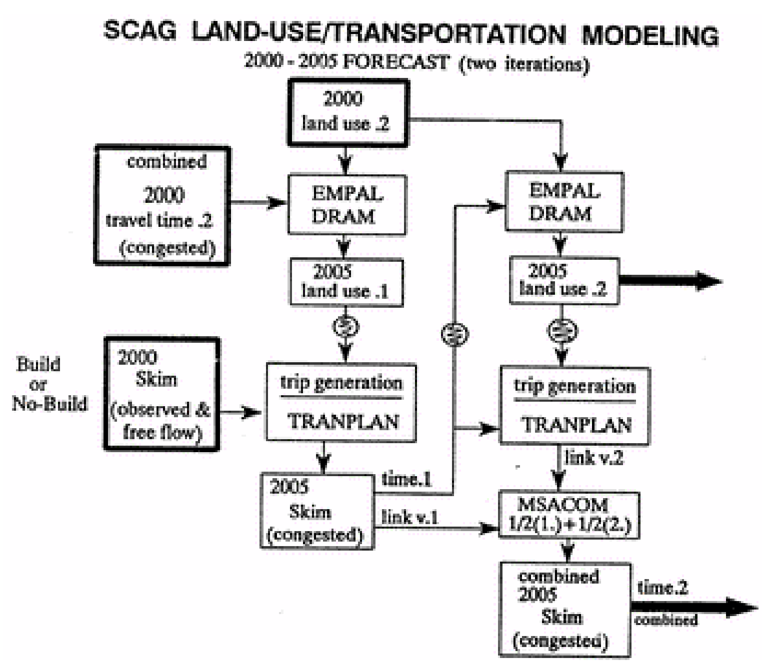


Figure 4-3: 2000-2005

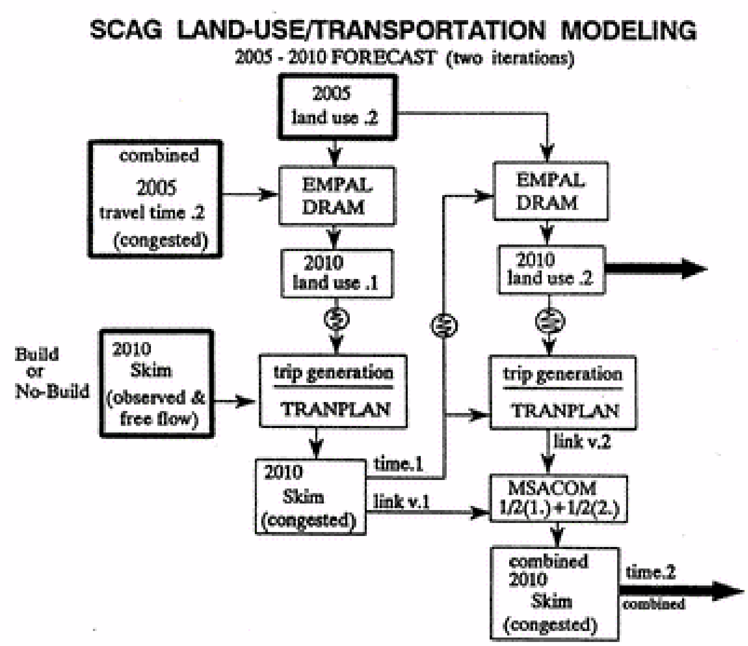


Figure 4-4: 2005-2010

For each five-year run, the land use and transportation models were carried out in the following procedures. First, congested travel time data from the regional transportation model for either the build or no-build scenario was a primary input along with base year land use data to the DRAM/EMPAL model. Travel time for each of the 1527 zones were aggregated to the 772 DRAM/EMPAL zonal system before running the land use model. The result of the first set of socioeconomic distributions is reflective of the differences in the relative zone to zone travel times.

These data are then disaggregated to the 1527 zones of the regional transportation model, and become inputs to the first iteration of the transportation model. The transportation model was then run for either the build or no-build scenarios, changing the socioeconomic inputs to reflect these new distributions. Again the output of the transportation model is a set of congested travel times for the build or no-build network, which are then run back through the second iteration of the DRAM/EMPAL model.

After two complete iterations, the travel times for each scenario for both runs were examined. Initially, travel times tend to be somewhat unstable, as the DRAM/EMPAL model shifts employment and households to those locations which witness the most significant reduction in travel times due to facility development. But the model in turn "overcongests" those same networks, and in the next iteration, an increment of that growth is subtracted to reflect that overcongestion. A third iteration was run to reflect what represents an approximate equilibrium, and the resulting socioeconomic distribution was then input back to the transportation model for the final emissions analysis. The land use changes associated with the final DRAM/EMPAL run are those reported below.

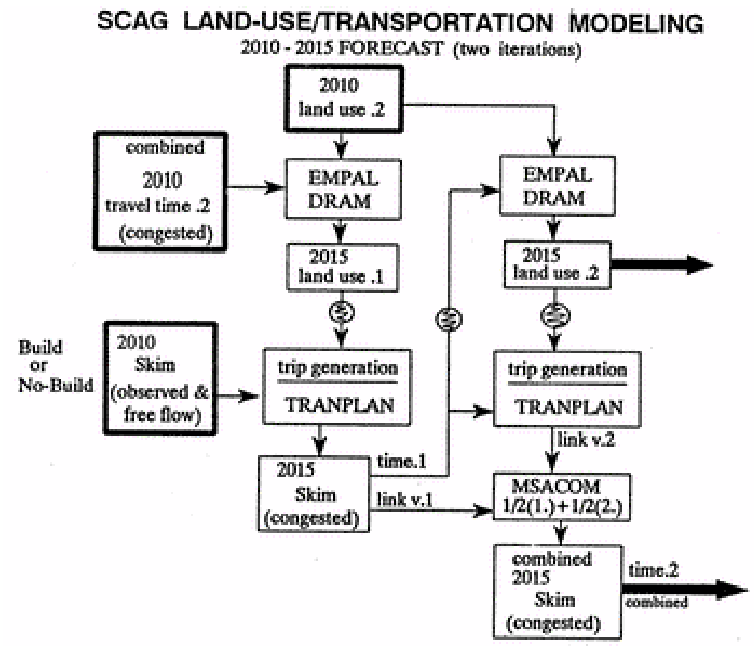
C. Analysis of Socio-Economic Data

Before presenting the results of the analysis, a word of caution is advised. This sensitivity analysis does not reflect a widely accepted or established methodology for land use analysis. By an large, this still remains an area which both deserves, and is undergoing, significant additional study. The model does not take account of adopted policies affecting land use (General Plans for example,) which would clearly limit the type of analysis conducted here. In many ways, it more closely approximates a "pure market" forecast of relative attractiveness according to the model's primary variables, and the difference in relative travel times. Given these caveats, the land use analysis is presented below.

The land use changes were examined at the sub-regional levels, for the two primary variables of the DRAM/EMPAL model, employment and households. As can be seen, the most dramatic changes associated with travel time improvements of the build scenario occurred on employment locations. This was somewhat unexpected. Prior sensitivity analyses had indicated that households were generally more sensitive to travel time changes, while several employment sectors were rather "sticky" in their locational freedom.

The general pattern in comparing the two scenarios is the greater relative attractiveness of the Eastern end of the modeling area, namely the subregions in Riverside and San Bernardino counties, as illustrated in Figure 4-5. This can be attributed to two primary factors. First, as a result of the transportation improvements in the Eastern portion of the modeling area, the relative travel times are reduced, making these areas more attractive for employment location, than they would be without such improvements. Their greater relative attractiveness as compared to the central portion of the modeling area, with somewhat fewer transportation improvements, accounts for the negative differences for the two scenarios in the central area. It is important to note, that this does not constitute a decline, as the central area continues to register significant future job growth in the two scenarios. But the central area becomes slightly less attractive relatively, under the two scenarios.

Figure 4-5: 2010-2015



The second factor would be related less to the transportation improvements, and perhaps more to the nature of employment growth. Given the level of population and household growth forecasted for the Eastern area, certain employment sectors tend to "follow" population. Retail employment is such a population serving sector that lags household growth. While such growth affects both the build and the no build scenarios, the greater residential locational freedom associated with the build scenario, should have a similar impact on employment in this area.

The sectors which were most significantly impacted were F.I.R.E. (Finance, Insurance and Real Estate), which grew by roughly 20,000 jobs in both Riverside and San Bernardino over the no-build scenario, manufacturing which increased by over 13,000 in the case of Riverside, and 1 0,000 in San Bernardino, and wholesale trade, which added roughly 10,000 additional jobs per county.

The most significant areas which "suffered" under the build scenario are the Central Los Angeles and Santa Monica Bay subregions, which both 'lose' over 20,000 future job growth as a result of the greater relative attractiveness of other areas. A significant anomaly is the San Bernardino forest, which because it was not constrained in the model, was allocated significantly greater growth in the no-build scenario than in the build. Under normal modeling conditions, this area would be constrained such that it could not exceed currently forecasted levels of growth, which account for the sensitive development potential. In general, the analysis indicates that the travel time changes associated with the transportation improvements would allow for a slightly more dispersed pattern of employment growth, one which favors the peripheral areas over the central ones. These shifts are relatively minor in most cases, with the exception of the relative increases in both San Bernardino and Riverside counties, which both register relative changes in the 10 percent range.

It should be pointed out that such a dispersed pattern on the employment side may not necessarily have a negative impact from an air quality point of view. To the extent that commuting distances are shortened, such a dispersed pattern could in fact prove to be beneficial. The employment changes by subregion are presented below in Table 4-1.

Table 4-1: Employment Change Build V. No Build 2010

Subregion Name	Build Minus No Build	Percent Change
Los Padres	0	0.0%
Oxnard / Ventura	4,481	1.6%
Semi / Thousand Oaks	2,670	1.6%
North Los Angeles Co.	2,124	1.3%
Santa Clarita	-137	-0.1%
San Fernando	-11,218	-1.2%
Santa Monica Mts	170	0.2%
Santa Monica Bay	-22,599	-2.1%
Central Los Angeles	-27,524	-1.8%
Glendale / Pasadena	-8,536	-1.1%
Long Beach / Downey	-5,195	-0.6%
East San Gabriel	6,481	1.3%
W. San Bernardino Val.	29,213	10.0%
E. San Bernardino Val.	26,039	9.8%
San Bernardino Forest	-46,958	-51.5%
Angeles Forest	0	0.0%
Northwest Orange Co.	3,310	0.3%
Southeast Orange Co.	-6,519	-0.9%
Riverside / Corona	27,461	11.7%
Central Riverside	26,739	13.7%

The analysis on the household side indicates a much weaker trend. In no case did the shift between the two scenarios exceed two percent. The greatest loss occurs in the Santa Monica Bay and Glendale/Pasadena areas, with additional smaller changes in the Central Los Angeles and San Fernando areas. The areas of growth include the same sub-regions within San Bernardino and Riverside Counties, although it should be pointed out that in all cases, the changes are relatively small. Given the small percent changes on the household side, it is less clear that such shifts fall into the category of statistical significance, as shown in Table 4-2.

Table 4-2: Household Change Build V. No N\Build 2010

Subregion Name	Build Minus No Build	Percent Change

Los Padres	0	0.0%
Oxnard / Ventura	-1,142	-0.5%
Semi / Thousand Oaks	-485	-0.3%
North Los Angeles Co.	-454	-0.5%
Santa Clarita	-219	-0.5%
San Fernando	-2,203	-0.4%
Santa Monica Mts	-266	-0.6%
Santa Monica Bay	-8,175	-1.2%
Central Los Angeles	-1,112	-0.2%
Glendale / Pasadena	-3,414	-0.6%
Long Beach / Downey	718	0.1%
East San Gabriel	2,178	0.6%
W. San Bernardino Val.	4,2000	1.7%
E. San Bernardino Val.	2,828	1.3%
San Bernardino Forest	1,451	1.5%
Angeles Forest	0	0.0%
Northwest Orange Co.	-396	-0.1%
Southeast Orange Co.	701	0.2%
Riverside / Corona	3,807	1.6%
Central Riverside	1,980	1.1%

The regional pattern is similar to that exhibited by employment, namely that there is a de-centralization of household location associated with the greater relative travel time reductions which occur primarily on the eastern end of the modeling region. The direction of the shift is consistent with expectation, both for the reduction of point to point travel times which allow individuals to travel greater distances to their work locations, as well as consistent with the levels of employment growth forecasted for these areas (see Figure 4-6). The logic of the model indicates that as travel times decrease, a more decentralized pattern is allowed, while with little improvement, the residential pattern would tend towards greater centralization.

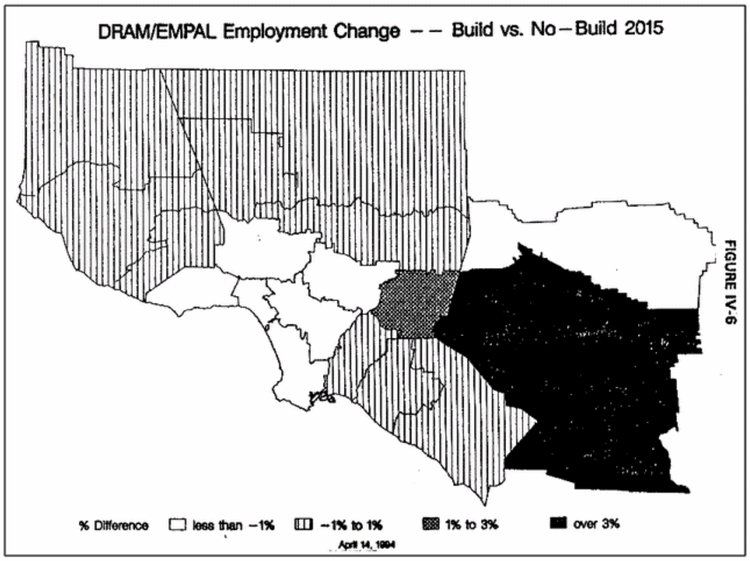


Figure 4-6: DRAM/EMPAL Employment Change

The revised distribution associated with the build scenario will have a corresponding impact on other travel characteristics. Because of the lower congestion index and more people living outside their work places, the number of regional trips increases by 1.6%. At the same time, vehicle miles traveled decreases, which would largely be a function of the increase in employment in the Eastern area, and the resulting shorter distance traveled from home to work. Because of the decline in congestion, the number of vehicle hours decreases by 17%, and the congestion index declines by roughly the same amount. Average Speeds increase by over 4 miles an hour over the system (see Table 4-3).

Table 4-3: Vehicle Trip Assignment

AM Peak	2010 NB	2010 B
Veh-Trips	7,277,386	7,394,066
(+ intrazonal)	8,459,440	8,451,598
VMT	75,732,640	74,728,864
Speed (mi/hr)	21.2	25.5

The related emission analysis (see Table 4-4) indicates improvement of over 22 tons per 3-hour AM peak period in carbon monoxide emissions, a decrease of half a ton per AM peak of nitrous oxides, and a reduction of 4.3 tons of reactive organic gases. The significant reductions of CO and ROG are attributable to the reduced number of vehicle miles traveled associated with the congestion relief (higher speed) afforded by the RTIP implementation, and with "balanced" socioeconomic distributions. On balance, the land use sensitivity analysis indicates an improvement on the emissions side associated with the implementation of the RTIP.

Table 4-4: Summary of Mobile Source Emissions -

Tons/AM Peak Period		
Emissions	**2010 NB**	**2010 B**
CO	288.86	266.33
NOX	38.44	37.90
ROG	36.13	31.86

Although vehicle trips have been increased in the build scenario, the overall vehicle miles traveled clearly decreases because of a more balanced land use distribution. While we should view these results cautiously, the slight improvement in the total emissions picture associated with the build scenario, underscores the importance of geographic distribution in emissions analysis.

Emission Budget Analysis by Air Basin

Rate of Progress Plan

SCAG has determined consistency of the 1993/99 RTIP Amendment with emission budgets for each pollutant established by the submitted attainment plans. However, the emission results could not be compared directly due to different calculation methods used (DTIM v BURDEN, allowance for enhanced I & M, etc.). SCAG discussed this issue with the Environmental Protection Agency and both agreed the basis for this analysis will be upon comparison of the fundamental assumptions used in development of the RTIP Amendment and Rate of Progress Plans (ROP) for each air basin. The key assumption between the ROP and the RTIP for the purposes of comparison and the only assumption that differs between the ROP and the RTIP is the amount of vehicle miles traveled growth rate from 1990 to 1996. The VMT growth rate used for each air basin is shown in this illustration. Additionally, SCAG compared the applicable emission budgets in the SCAB for carbon monoxide and nitrogen dioxide.

RATE OF PROGRESS PLAN
VMT GROWTH RATE ASSUMPTION USED FOR THE YEARS 1990 TO 1996

AIR BASIN	RATE OF PROGRESS	RTIP AMENDMENT
SCAB	8.3%	8.0%
SCCAB	9.1%	7.3%
SEDAB	40.2%	37.9%

CARBON MONOXIDE ATTAINMENT PLAN

CARBON MONOXIDE (Tons/Day)
ATTAINMENT YEAR 2000

	BUDGET	1993/99 RTIP AMENDMENT YEAR 2000 BUILD SCENARIO
SCAB	3028[1]	2162[1]

Figure 4-7: DRAM/EMPAL Household Change

CHAPTER 5: FUTURE MODEL IMPROVEMENTS

SCAG is currently engaged In a model improvement program to be completed this fiscal year. Several components are under way; a trip generation and a trip distribution model are already contracted by Orange County E.M.A. Also SCAG has contracted with a consulting team headed by Cambridge Systematics, Inc. to develop new mode choice models for the region. The new model improvement program will make use of the 1990 Census and data from the 1991 Origin and Destination Travel Survey.

CHAPTER 6: SUMMARY AND FINDINGS

Technical Findings

Results of the emissions analysis (Tables 3-3, 4, 5, and 6) show that implementation of the projects in the FY 1993-1999 Regional Transportation Improvement Program Amendment contributes to emission reductions in carbon monoxide (CO), nitrous oxide (NOX), and reactive organic gases (ROG).

1. The Year 2000 'Build' and 'No Build' emissions (CO, NOX, and ROG) are less than the Year 1990 emissions for CO, NOX, and ROG.

2. The Year 201 0 'Build' and 'No Build' emissions (CO, NOX, and ROG) are less than the Year 1990 emissions for CO, NOX, and ROG.

3. The year 201 0 'Build' And 'No Build' emissions (CO, NOX, and ROG) are less than the Year 2000 'Build' and 'No Build' emissions for CO, NOX, and ROG.

4. The year 2015 'Build' and "No Build" emissions (CO, NOX, and ROG) are less than the Year 201 0 'Build' and 'No Build' emissions for CO, NOX, and ROG.

5. The Year 2000 'Build' emissions (CO, NOX, and ROG) are less than the Year 2000 'No Build' emissions for CO, NOX, and ROG.

6. The Year 2010 'Build' emissions (CO, NOX, and ROG) are less than the Year 2010 'No Build' emissions for CO, NOX, and ROG.

7. The Year 2015 'Build' emissions (CO, NOX, and ROG) are less than the Year 2010 'No Build' emissions for CO, NOX, and ROG.

Therefore, the FY 1993/99 RTIP Amendment contributes to reductions in CO, NOX, and ROG for all years.